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TRANSPLANTING RICE SEEDLING USING MACHINE TRANSPLANTER: A POTENTIAL STEP FOR MECHANIZATION IN AGRICULTURE

Md Sirajul Islam, M Mahbubur Rashid, Ashick Ahmed and M Abid-Ul-Kabir share their experience of transplanting rice seedling using machine transplanter in Bangladesh.

CONTEXT

Rice is the staple food of about 160 million people of Bangladesh. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intakes of an average person in the country. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. Almost all of the 17 million farm families of the country grow rice. Rice is grown in about 10.5 million hectares (ha) of land which remains unchanged over the past three decades.

A field demonstration of machine transplanter during T. Aman 2012 in Rajshahi district

For successful rice cultivation, availability of quality seeds and seedlings, land preparation, transplanting seedlings in optimum time (with uniform spacing) are important. These are time-

consuming and expensive as labour cost accounts the biggest input for rice production. Though land is mostly prepared mechanically, raising of seedlings and transplanting are still being done manually in Bangladesh.

To produce rice from a hectare of land, about 156 person days are required. Of these 45 person days are needed for raising seedlings and transplanting which is about 29% of the total labour required. Though a contract system for undertaking transplanting evolved during this period, the careless attitude of contract labourers (aggressive pulling of seedlings from the nursery, clipping seedlings and transplanting at more depth with insufficient plant density, etc) to complete the work in the shortest possible time has been affecting the productivity of rice in Bangladesh. Though the work standards have been declining, these contract labourers have started demanding higher wages every year.

Box 1: A Brief History of Machine Transplanting in Rice

Mechanical transplanting in rice involves transplanting specifically raised younger seedling of rice as a mat (mat type nursery) using a self-propelled mechanical rice transplanter at pre-determined and desired spacing. Machine transplanter was first developed in Japan in 1960s, whereas the earliest attempt to mechanize rice transplanting dates back to late 19th century. In Japan, development and spread of rice transplanters progressed rapidly during 1970s and 1980s. They also developed new technologies of seedling raising for rice transplanter (Tasaka *et al*., 1996). In Bangladesh, BRAC's Agriculture and Food Security Programme and GBK (Golden Barn Kingdom) introduced walking type mechanical rice transplanter and tested in different project locations during wet season of 2012 and dry season of 2013 to evaluate the field performance.

INTERVENTIONS

Considering these issues, the Agriculture and Food Security Programme of BRAC and GBK (Golden Barn Kingdom) had taken a collaborative programme on machine transplanting of rice to disseminate this technology, with the following objectives:

- Ensure quality seedlings in proper time by raising seedlings in the tray under plastic shade
- Ensure uniform spacing and planting depth of transplanted rice
- Save time and cost during periods of peak-labour demand
- Create new forms of employment through creation of seedling nursery entrepreneurs and transplanting service providers
- Improve farmers socio-economic conditions

Seedling establishment in tray: needed for mechanical transplanting of rice

Primarily 7.6 ha of 15 farmers at Talondo, Tanor of Rajshahi and 7.4 ha of 18 farmers at Tunipara, Sherpur of Bogra districts were selected to demonstrate machine transplantation versus manual transplantation in the wet season 2012. During the dry season (2012-13) the advantages of machine transplantation (in comparison to conventional agriculture) were evaluated. Machine transplanting showed better performance compared to manual transplanting and this convinced farmers to adopt this technology in future.

Box 2: Agriculture and Food Security Programme (AFSP) of BRAC and GBK

AFSP is trying to enhance food security and reduce hunger and malnutrition through promotion of environmentally sustainable agricultural production system. Besides agricultural research, development and marketing, the programme is also disseminating agricultural technologies through farmers' participatory large scale block demonstration. The programme's objectives are to engage in adaptive research in addressing emerging challenges in the agricultural sector, promoting higher production through cost effective and sustainable technologies, providing quality inputs and innovative financial and marketing services.

Golden Barn Kingdom Pvt. Ltd (GBK) is an agro input based multinational company that has made its debut in mechanized agriculture to boost rice production in Bangladesh. With this vision, the company has introduced the globally recognized 'tray method' in rice plantation to plant sapling through machines in the country's rice fields.

GOOD PRACTICES

Survey and selection of participants: To introduce the new technology in farmers' field, BRAC'S technical assistance team made a survey at the very beginning of the planting season. The following criteria were used for the final selection:

- Marginal farmer
- Engaged in agriculture either in own land or by lease
- Permanent resident of the locality
- National ID card and
- Interested in receiving training or orientation from the programme

Field supervision by BRAC's Agronomist in Rajshahi district in T. Aman 2012

Training farmers: Though the farmers were experienced in rice cultivation, they mostly lacked knowledge on farm mechanization. BRAC and GBK's staff provided practical training to select farmers by field demonstration. The training materials focused on selection of quality seeds and crop varieties, raising seedlings in mat type nursery, transplanting rice using machine transplanter by skilled operators and management for higher yield with less production cost. The goal of this training was to create nursery entrepreneurs and trained machine operator from them to replicate this technology in the *dry* season of 2012-13.

Crop cutting session

Questionnaire for farmer: In the *dry* season 2012-13, a questionnaire was prepared for 21 farmers in Paba and Darusha upazila of Rajshahi district to make a clear understanding of farmers demand and the future prospects of this technology on the socio-economic aspects of marginal farmers. All farmers under this survey made a positive response to this new technology especially in *dry* season as the issue of quality seedling and availability of labor are two major issues in this season.

Technical support: BRAC and GBK's technical staff monitored the activities of the farmers of each district once in a week and provided agronomical support wherever it was needed. Problems faced by farmers were discussed during these supervisory visits and expert advice on solving these issues was provided.

Field days: BRAC and GBK organized field days synchronizing with the crop harvest during *wet* season 2012. BRAC invited the neighbouring farmers (both husband and wife), government officials, policy makers, GO-NGO extension providers, local leaders, social workers and staff of mass media for wider dissemination of these new technologies. Around 200 farmers (male and female) attended in crop cutting sessions and field days. The neighbouring farmers had interactions with the participating farmers and learned about the technology and profitability.

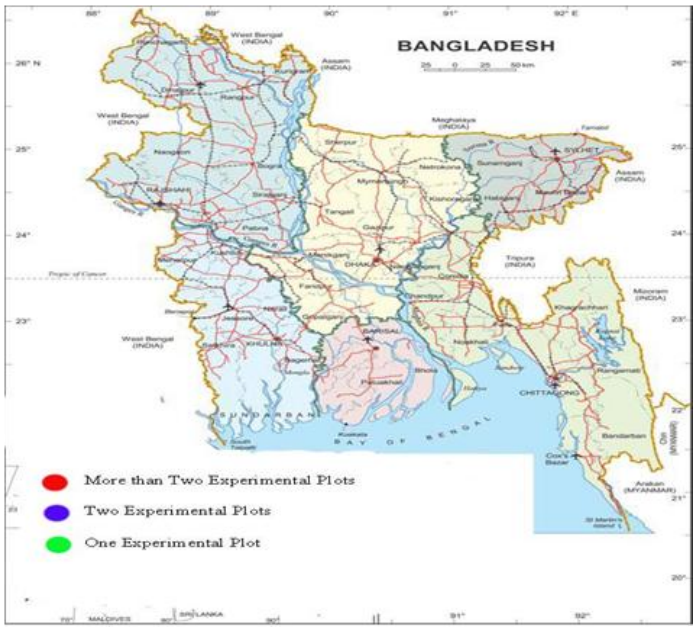
Field days during the project implementation

BENEFITS AND IMPACT

Operationally, the machine transplanting differs from manual transplanting method in nursery raising, seed rate, seedling age and transplanting system. The other activities like weeding, irrigation, fertilizer application, plant protection, harvesting, threshing and bagging are same in both cases. In the demonstration trial, machine transplantation resulted in earlier maturity of the crop (by 15 days) and 9% increased production compared to manual transplantation. Besides higher yield, 25-30% production cost was reduced by using machine transplanter.

The total number of rice transplanter are presently used in Bangladesh is 78. Rice transplanters were used in 1400 experimental and exhibition plots and covers 2041 ha of land (Anonymous 2013). It was used in 200 upazillas under 50 districts of Bangladesh. Still now most of the places it is used only experimental basis.

From recent data, it is observed that total numbers of farmers trained on the use of rice transplanter were 3329, where 1840 and 1331 were preliminary trained and 70 and 88 were expert trained farmer by Government organization and private sectors, respectively.



Locations of Machine Transplanter spread in Bangladesh

CONCLUSIONS

- Rice transplanting using machine transplanter is technologically viable and economically feasible. But the cost of 4 rows machine transplanter is high (approximately 200000 BDT or 2500 US$) and this constrain smallholder farmers from adopting this technology. However some of the following measures can enhance adoption. Government may enhance the subsidy component for promoting this technology from 50 to 75 per cent so that every farmer could afford a machine transplanter and can do timely operations
- A healthy agricultural mechanization policy must be formulated immediately including machine development and manufacturing, quality protection by standardization of machines, skill development of researchers, farmers, mechanics and machine operators and marketing system improvement
- Funds for relevant machinery research, development and extension are to be provided to the capable institutions including selected Agricultural Research Institutes and Universities on competitive basis. This stimulates quality research to produce new machines within possible shortest time. Also it enhances farm activities and agricultural machinery industries.

- The existing tariff rates affect the import of agricultural machines, spare parts and raw materials needed to manufacture those machines and spare parts. Reduction in tariff rates can encourage local manufacturers to work on a competitive basis. This will also reduce the import dependency and increases the capacity of the local manufacturers and the employment opportunity in non-farm sector.
- Before distributing these implements to farmers, efforts should be made to build the knowledge and skills of extension functionaries on use of these implements
- Region based seedling industry should be established so that seedling can be transported to the main field within a short time
- As resource poor farmers may not afford to buy this machine, a service provider group both from private and government sector can sell this service to them.

Mechanical transplantation resulted early maturation of rice in T. Aman 2012

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